CLAIMS

1. A pattern writing system comprising a substrate, a pattern projecting apparatus using light control elements arranged two-dimensionally and a microlens array to thereby project onto said substrate a pattern in the form of an aggregate of a large number of spots, and means for relatively moving said substrate with respect to said pattern projecting apparatus, characterized in that pattern writing is performed so that said substrate is moved obliquely with respect to an array of said large number of spots forming the pattern projected, whereby some of the spots included in said patterns caused by irradiation at different times overlap with each other at the same position on said substrate.

2. A pattern writing system according to claim 1, characterized in that said spots each have a polygonal shape.

3. A pattern writing system according to claim 1, characterized in that an intensity of irradiation of each spot has an intermediate gradation by one-time irradiation and a required intensity is achieved when the spots are irradiated to overlap with each other a predetermined number of times on the same position on said substrate.

4. A pattern writing method for projecting an aggregate pattern of spots arranged in a matrix onto a substrate by relatively moving one of said aggregate pattern of the spots and said substrate in a predetermined moving direction, said pattern writing method characterized by the steps of:

rendering rows or columns of said aggregate pattern of the spots into an oblique state with respect to the predetermined moving direction and;

performing pattern writing by moving said one of said aggregate pattern of the spots and said substrate in said predetermined moving direction, with the oblique state kept intact.

5. A pattern writing method according to claim 4, characterized in that the spots forming said aggregate pattern of the spots are projected to the same

positions on said substrate a plurality of times during movement of said substrate in said predetermined moving direction.

6. A pattern writing method according to claim 5, characterized in that the spots projected to the same positions on said substrate the plurality of times are provided by light control elements that are ON/OFF controlled.

7. A pattern writing method for writing a pattern on a substrate by introducing exposure light incident from a light source onto a mirror device incldуding micromirrors arranged two-dimensionally and by using a projection pattern output from said mirror device, said pattern writing method characterized by:

directly projecting or reduction-projecting projection patterns output from said mirror device and;

overlapping the projection patterns with each other a plurality of times over the substantially whole surface of a pattern projection area on said substrate so as to perform exposure.

8. A pattern writing method according to claim 7, characterized in that a wavelength-conversion solid-state laser or a microwave-excited excimer laser is used as said light source.

9. A pattern writing method according to claim 7, characterized in that the second harmonic of a solid-state laser or a copper vapor laser is used as said light source and said projection light is subjected to wavelength conversion and is projected onto said substrate.

10. A pattern writing system characterized by comprising a mirror device including micromirrors arranged two-dimensionally, a light source for supplying exposure light to said mirror device, a substrate for mask pattern writing, a moving mechanism for moving said substrate in X- and Y-directions, means for directly projecting or reduction-projecting projection patterns output from said mirror device onto said substrate, and control means for overlapping

said projection patterns a plurality of times over the substantially whole surface of a pattern projection area on said substrate to thereby perform exposure.

11. A pattern writing system according to claim 10, characterized in that a wavelength-conversion solid-state laser or a microwave-excited excimer laser is used as said light source.

12. A pattern writing system according to claim 10, characterized by using the second harmonic of a solid-state laser or a copper vapor laser as said light source and further comprising a wavelength conversion element for converting a wavelength of said projection light.

13. A pattern writing system according to claim 11, characterized by including a plurality of said wavelength-conversion solid-state lasers and further comprising means for averaging output lights output from at least two of said plurality of wavelength-conversion solid-state lasers and supplying the average ed light to said mirror device.

14. A pattern writing system according to claim 11, characterized by comprising a plurality of said wavelength-conversion solid-state lasers and a plurality of said mirror devices and further comprising means for averaging output lights of at least two of said plurality of wavelength-conversion solid-state lasers and supplying the average light to said mirror devices, respectively.

15. A pattern writing system according to claim 13 or 14, characterized in that said means for averaging said output lights and supplying the average light to said mirror device/devices comprises a beam splitter.

16. A pattern writing method according to claim 7, characterized in that said overlapping is accomplished by repeating a step of performing exposure by moving said substrate in an X-direction by part of an X-directional length determined for said projection pattern and then performing exposure by further moving said substrate in said X-direction by said part of the length.

17. A pattern writing method according to claim 16, characterized in that, after movement of said substrate in said X-direction is finished, said overlapping is performed by repeating a step of performing exposure by moving said substrate in a Y-direction by part of a Y-directional length determined for said projection pattern so that the projection patterns partly overlap also in said Y-direction and then a step of performing exposure by further moving said substrate in said X-direction by said part of the length.

18. A pattern writing method for writing a pattern on a substrate by the use of a projection pattern output from a mirror device, said pattern writing method characterized by performing writing in intermediate gradations by partly overlapping patterns written on said substrate to thereby perform exposure.

19. A pattern writing method for writing a pattern on a substrate by the use of a projection pattern that is obtained by introducing pulsed exposure light from a pulse light source onto a mirror device including micromirrors arranged two-dimensionally and by being output from the mirror device, said pattern writing method characterized by the steps of directly projecting or reduction-projecting projection patterns output from said mirror device so as to overlap with each other a plurality of times over the substantially whole surface of a pattern projection area on said substrate to thereby perform exposure and, on the basis of energy values of said pulse exposure light, controlling the number of overlapping times of said pulsed exposure light that exposes an area, on which each of said micromirrors is illuminated in said pattern projecting area on said substrate.

20. A pattern writing method according to claim 19, characterized by detecting part of the exposure light that is incident upon said mirror device to thereby measure the energy values of said exposure light and ON/OFF controlling said micromirrors on the basis of a measurement result.

21. A pattern writing method for receiving pulsed exposure light from a pulse light source at a mirror device including micromirrors arranged two-dimensionally and writing a pattern on a substrate by the use of a projection pattern output from said mirror device, said pattern writing method characterized by partly overlapping projection patterns output from said mirror device in a pattern projection area on said substrate to thereby perform exposure a plurality of times and reproducing a gray scale based on the number of overlapping times of said exposure light.

22. A pattern writing system for receiving pulsed exposure light from a pulse light source at a mirror device including micromirrors arranged two-dimensionally and writing a pattern on a substrate by the use of a projection pattern output from said mirror device, said pattern writing system characterized by comprising detection means for detecting energy values of said pulse exposure light and a correction device that calculates a gray scale for correcting energy variation in said pulse exposure light based on a detection result detected by said detection means and that ON/OFF controls said micromirrors forming said mirror device based on a calculation result.

23. In a method including a pulse laser light generating portion and two-dimensionally arranged micromirrors and performing pattern writing where said micromirrors are reduction-projected onto a substrate, a gray scale technique characterized by performing pattern transfer while overlapping, in both of two perpendicular moving directions on said substrate, projection patterns of said two-dimensionally arranged micromirrors, each projected onto said substrate by one-time pulse laser light.

24. A pattern writing system including a pulse laser light generating portion and two-dimensionally arranged micromirrors and reduction-projecting said micromirrors onto a substrate, said pattern writing system characterized by comprising means for generating pulse laser light and means for performing

pattern transfer while overlapping, in both of two perpendicular moving directions on said substrate, projection patterns of said two-dimensionally arranged micromirrors, each projected onto said substrate by one-time pulse laser light.

25. A pattern writing system according to claim 24, characterized by further comprising a pinhole plate that can divide, into a large number of fine light beams, the pulse laser light from the pulse light source applied to a mirror device including said micromirrors.

26. A pattern writing system according to claim 25, characterized in that said pinhole plate comprises a quartz glass and a metal film formed on a surface of said quartz glass, said metal film exposed in the shape of holes by the use of an electron-beam exposure system.

27. A pattern writing system according to claim 26, characterized in that said pinhole plate has a Peltier element.

28. A pattern writing method for receiving exposure light from a light source at a mirror device including micromirrors arranged two-dimensionally and writing a pattern on a substrate by the use of a projection pattern of the individual micromirrors output from said mirror device, said pattern writing method characterized by partly overlapping projection patterns from said mirror device at least in a one-dimensional direction with the lapse of time to thereby realize a gray scale.